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Kitago et al.

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(54) **WIRELESS COMMUNICATION APPARATUS, WIRELESS COMMUNICATION SYSTEM, AND DATA PROCESSING METHOD**

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H04M 1/656	(2006.01)
H04M 9/00	(2006.01)
H04R 1/10	(2006.01)

(52) **U.S. Cl.**

CPC ***H04R 27/00*** (2013.01); ***H04M 1/6041*** (2013.01); ***H04M 1/6066*** (2013.01); ***H04M 1/656*** (2013.01); ***H04M 9/001*** (2013.01); *H04M 2250/74* (2013.01); *H04R 1/1008* (2013.01); *H04R 2227/003* (2013.01); *H04R 2420/07* (2013.01); *H04R 2499/13* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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(57) **ABSTRACT**

A wireless communication apparatus which communicates with a first microphone is disclosed, which includes an audio processor which acquires audio data from the first microphone, a controller which detects an instruction for audio recording from the first microphone, an audio recorder which starts recording the audio data and stops the recording after a defined period of time since detection of the instruction for audio recording, a timer which starts measuring time for the defined period of time, and a memory controller which creates a recorded audio file, wherein the recorded audio file is linked to log information.

20 Claims, 9 Drawing Sheets

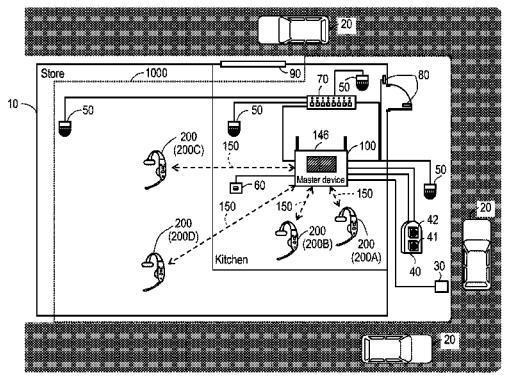

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FIG. 1

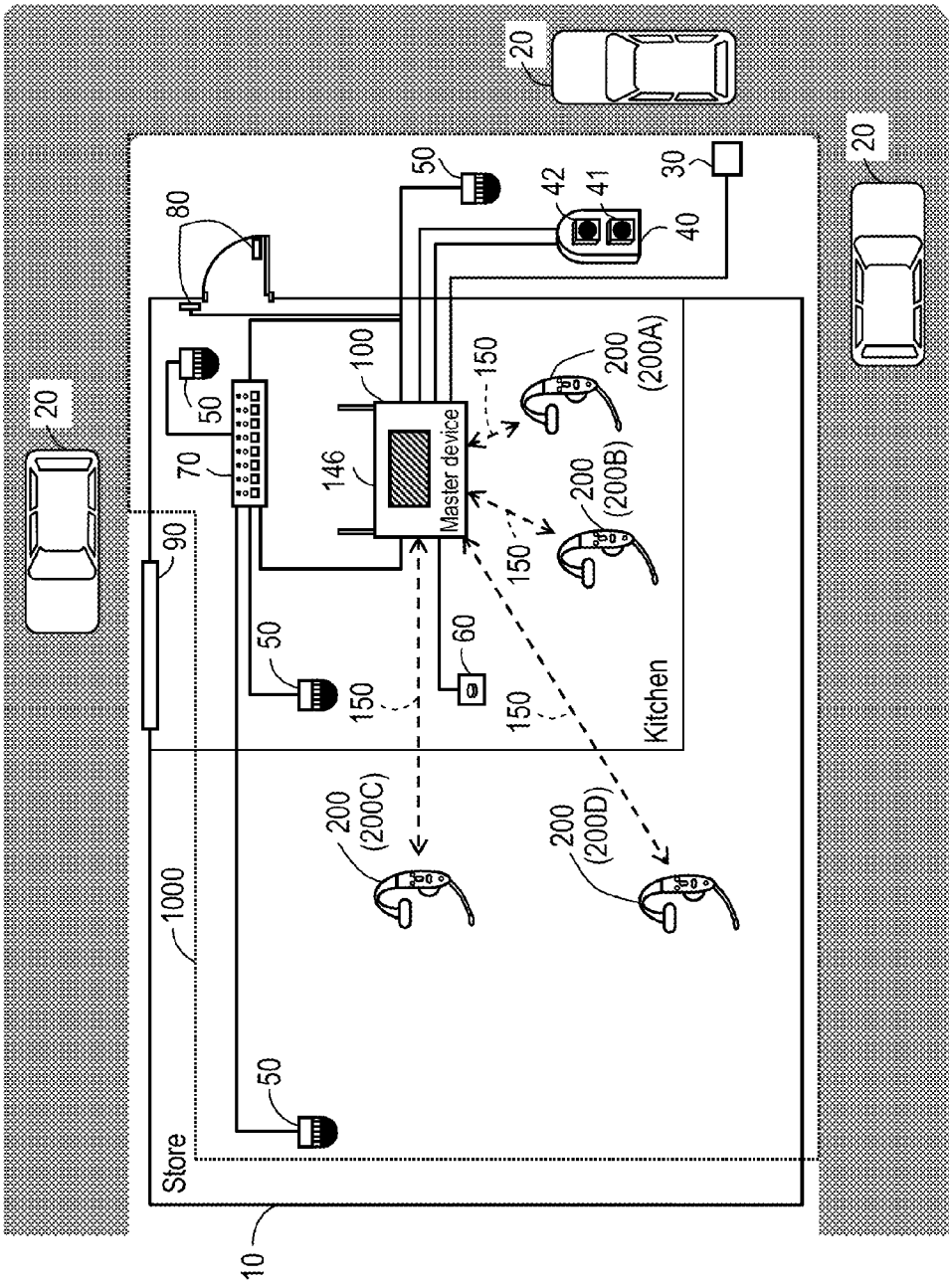

20
20
20
50
42
41
30
40
80
100
150
200
(200A)
50
70
146
Master device
200
(200B)
90
150
50
60
150
150
Kitchen
200
(200C)
200
(200D)
1000
50
Store
10

FIG. 2

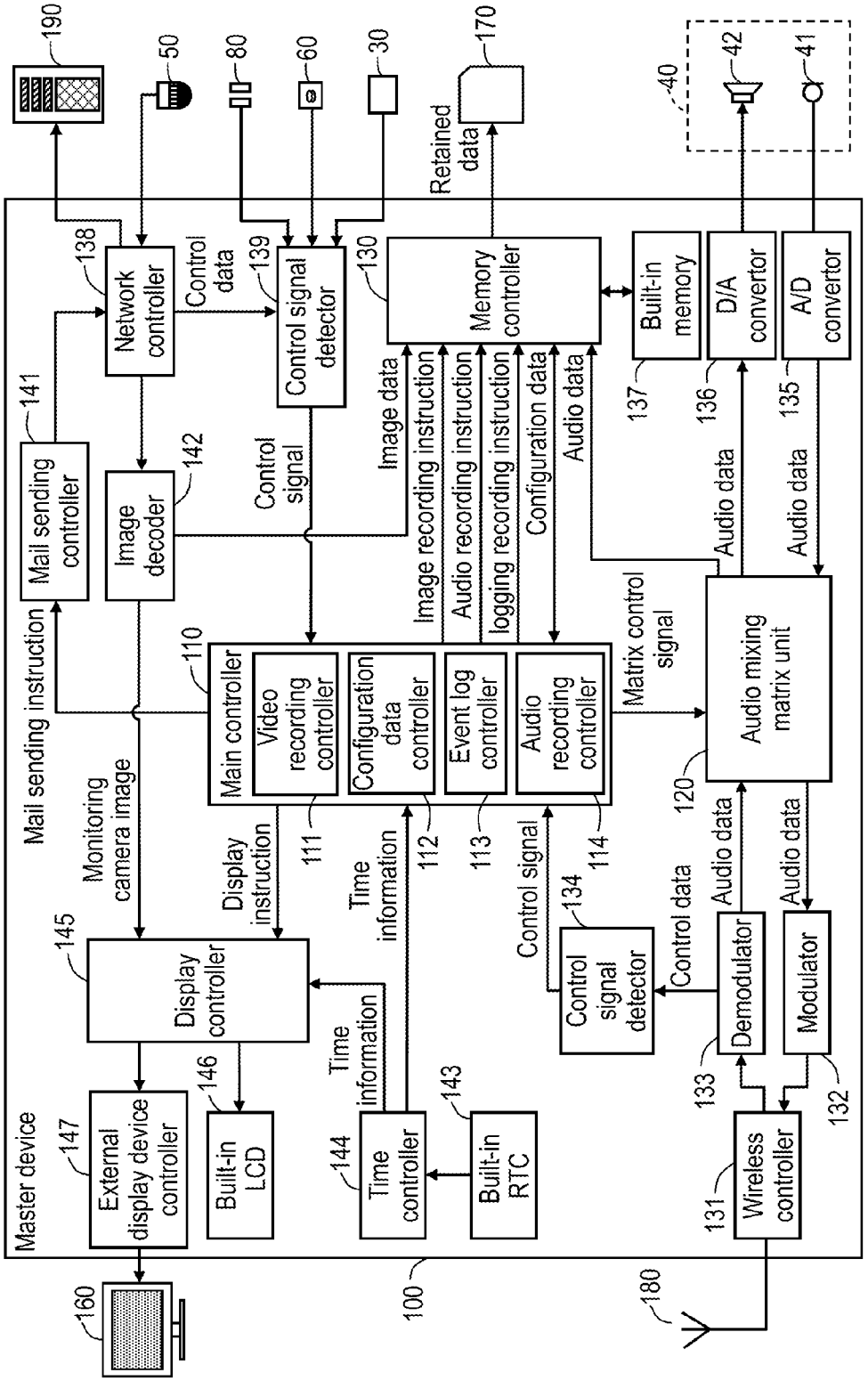

Master device
100
Main controller
110
Video recording controller
111
Configuration data controller
112
Event log controller
113
Audio recording controller
114
Network controller
138
Control data
139
Control signal detector
130
Memory controller
Retained data
170
Built-in memory
137
D/A convertor
136
A/D convertor
135
Mail sending controller
141
Image decoder
142
Control signal
Image data
Image recording instruction
Audio recording instruction
logging recording instruction
Configuration data
Audio data
Audio data
Audio data
Mail sending instruction
Monitoring camera image
Matrix control signal
Audio mixing matrix unit
120
Display instruction
Time information
Control signal
Audio data
Audio data
Display controller
145
Control signal detector
134
Control data
Demodulator
133
Modulator
132
External display device controller
147
Built-in LCD
146
Time information
Time controller
144
Built-in RTC
143
Wireless controller
131
180
160
190
50
80
60
30
40
42
41

FIG. 3

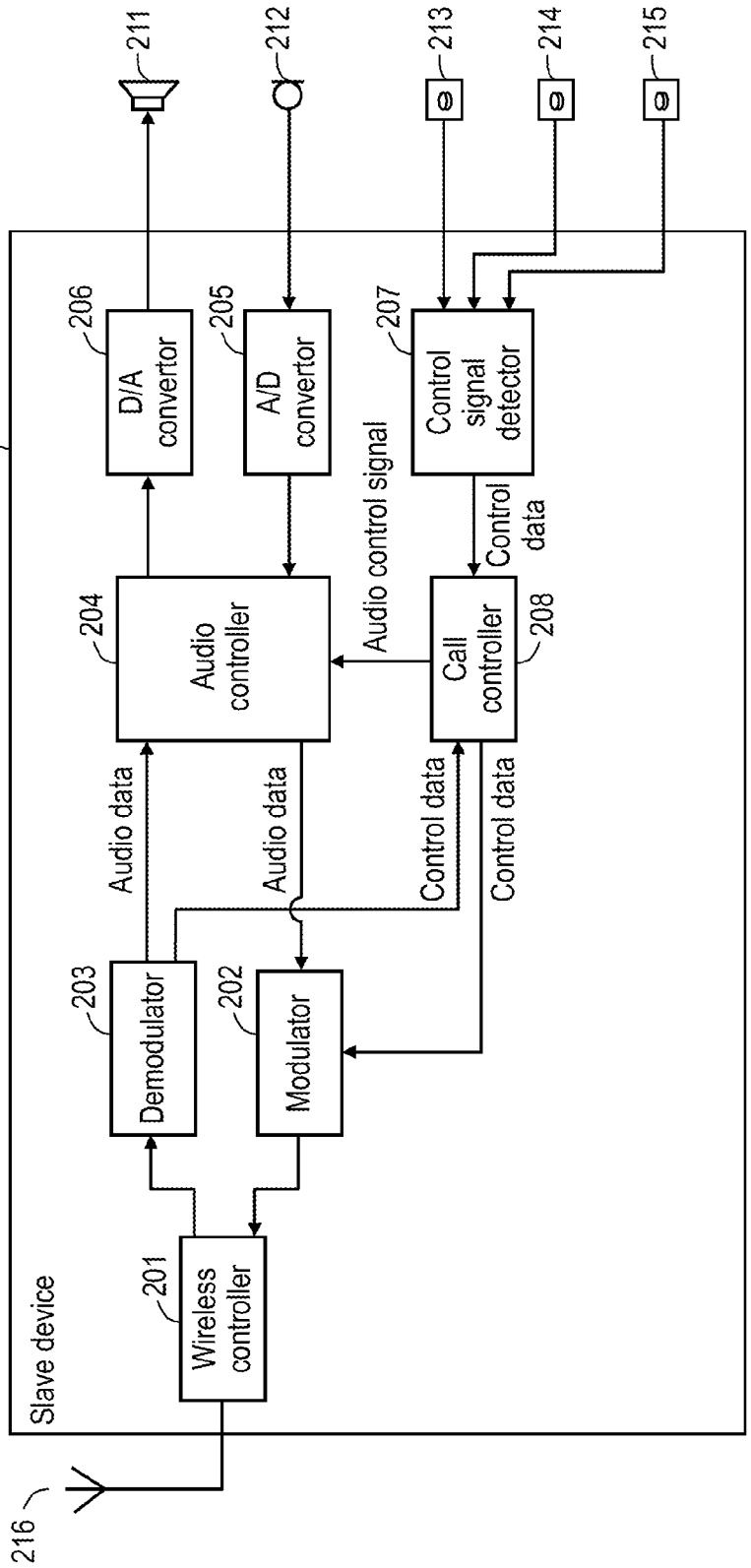

211
212
213
214
215
200
206
D/A convertor
205
A/D convertor
207
Control signal detector
Audio control signal
Control data
204
Audio controller
Call controller
208
Audio data
Audio data
Control data
Control data
203
Demodulator
202
Modulator
201
Wireless controller
Slave device
216

FIG. 4

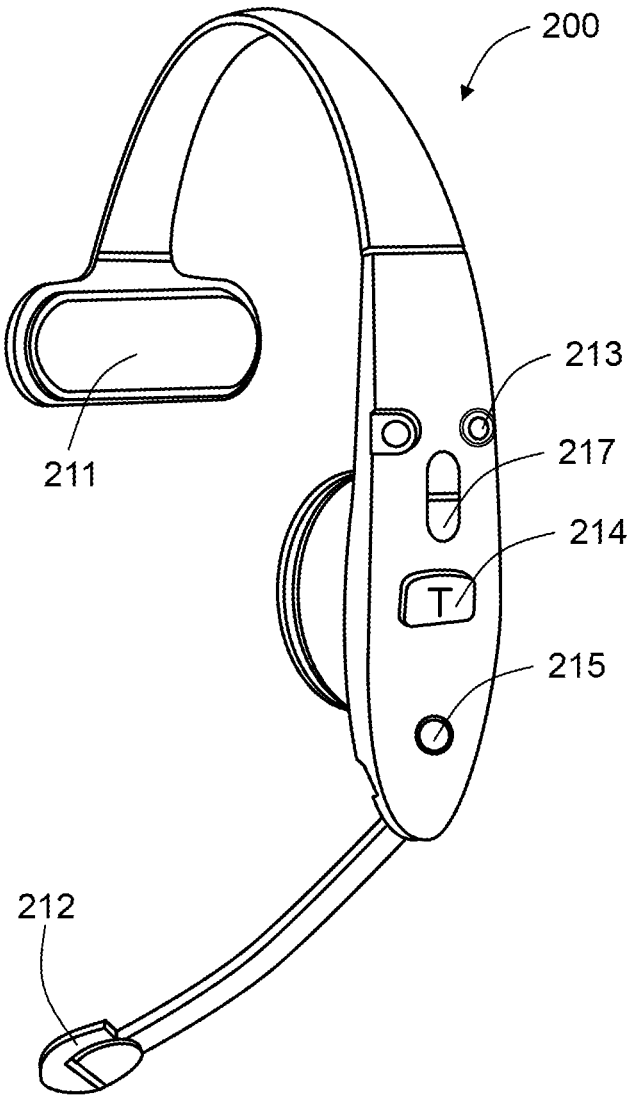


FIG. 5

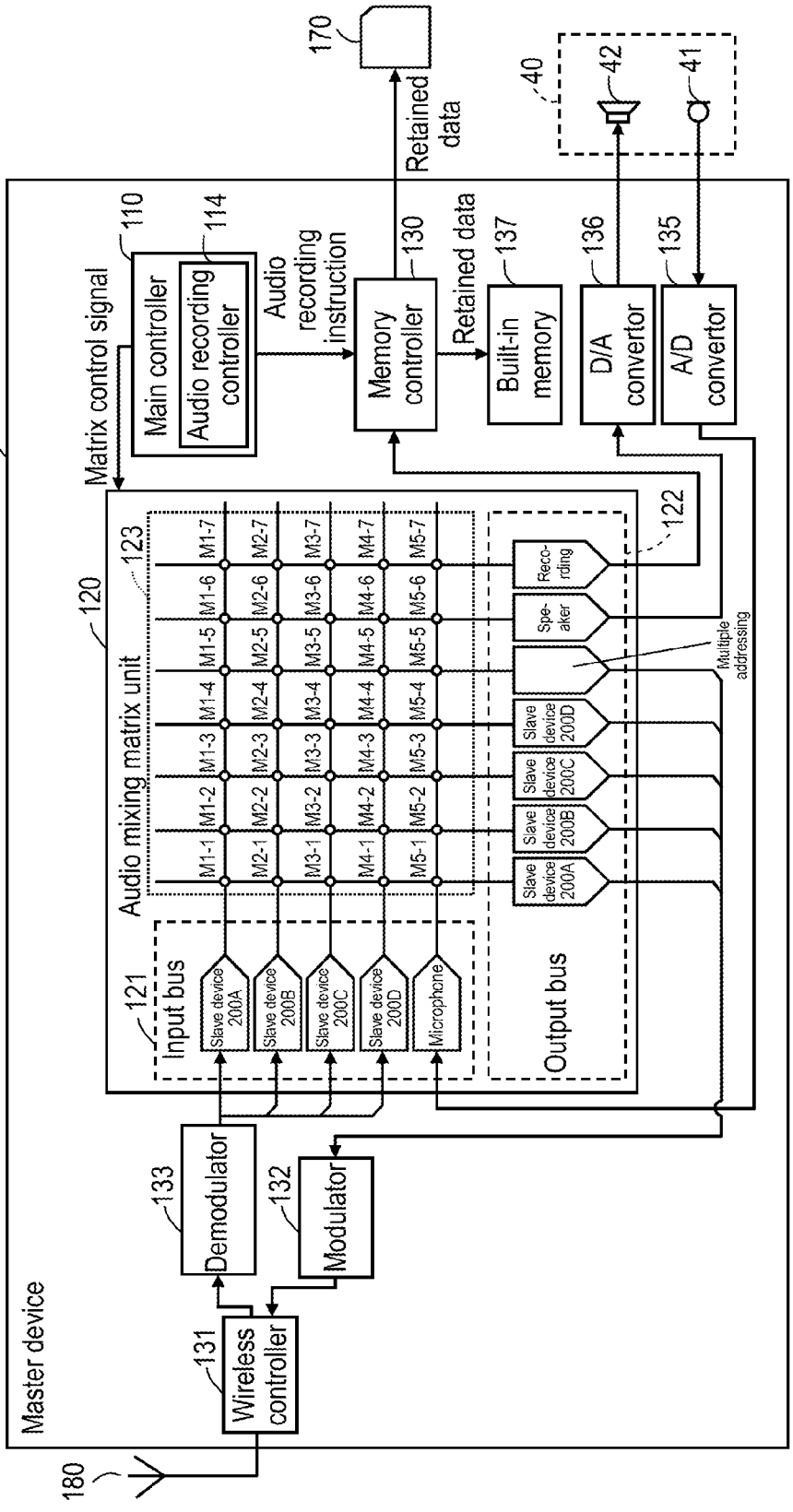

100
Master device
180
131
Wireless controller
133
Demodulator
132
Modulator
120
Audio mixing matrix unit
123
121
Input bus
Slave device 200A
Slave device 200B
Slave device 200C
Slave device 200D
Microphone
Output bus
122
Reco-rding
Spe-aker
Slave device 200D
Slave device 200C
Slave device 200B
Slave device 200A
Mutiple addressing
M1-1 M1-2 M1-3 M1-4 M1-5 M1-6 M1-7
M2-1 M2-2 M2-3 M2-4 M2-5 M2-6 M2-7
M3-1 M3-2 M3-3 M3-4 M3-5 M3-6 M3-7
M4-1 M4-2 M4-3 M4-4 M4-5 M4-6 M4-7
M5-1 M5-2 M5-3 M5-4 M5-5 M5-6 M5-7
Matrix control signal
110
Main controller
114
Audio recording controller
Audio recording instruction
130
Memory controller
Retained data
137
Built-in memory
136
D/A convertor
135
A/D convertor
40
42
41
170
Retained data

FIG. 6

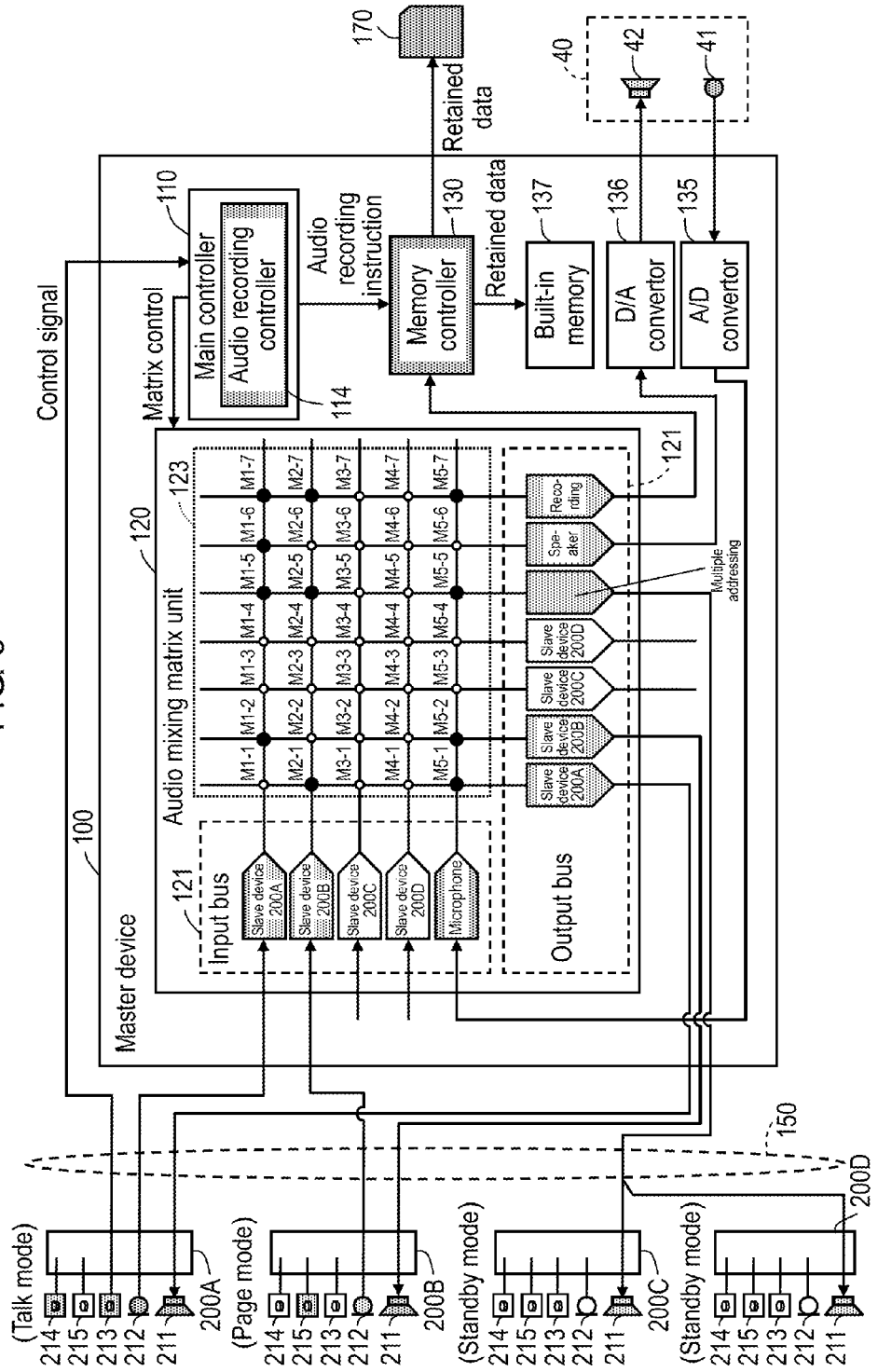

170
Retained data
40
42
41
110
Main controller
Audio recording controller
Audio recording instruction
130
Memory controller
Retained data
137
Built-in memory
136
D/A convertor
135
A/D convertor
Control signal
Matrix control
114
120
Audio mixing matrix unit
123
121
Input bus
Output bus
Slave device 200A
Slave device 200B
Slave device 200C
Slave device 200D
Microphone
Recording
Speaker
Multiple addressing
100
Master device
150
200D
(Talk mode)
(Page mode)
(Standby mode)
(Standby mode)
200A
200B
200C
211
212
213
214
215

FIG. 7

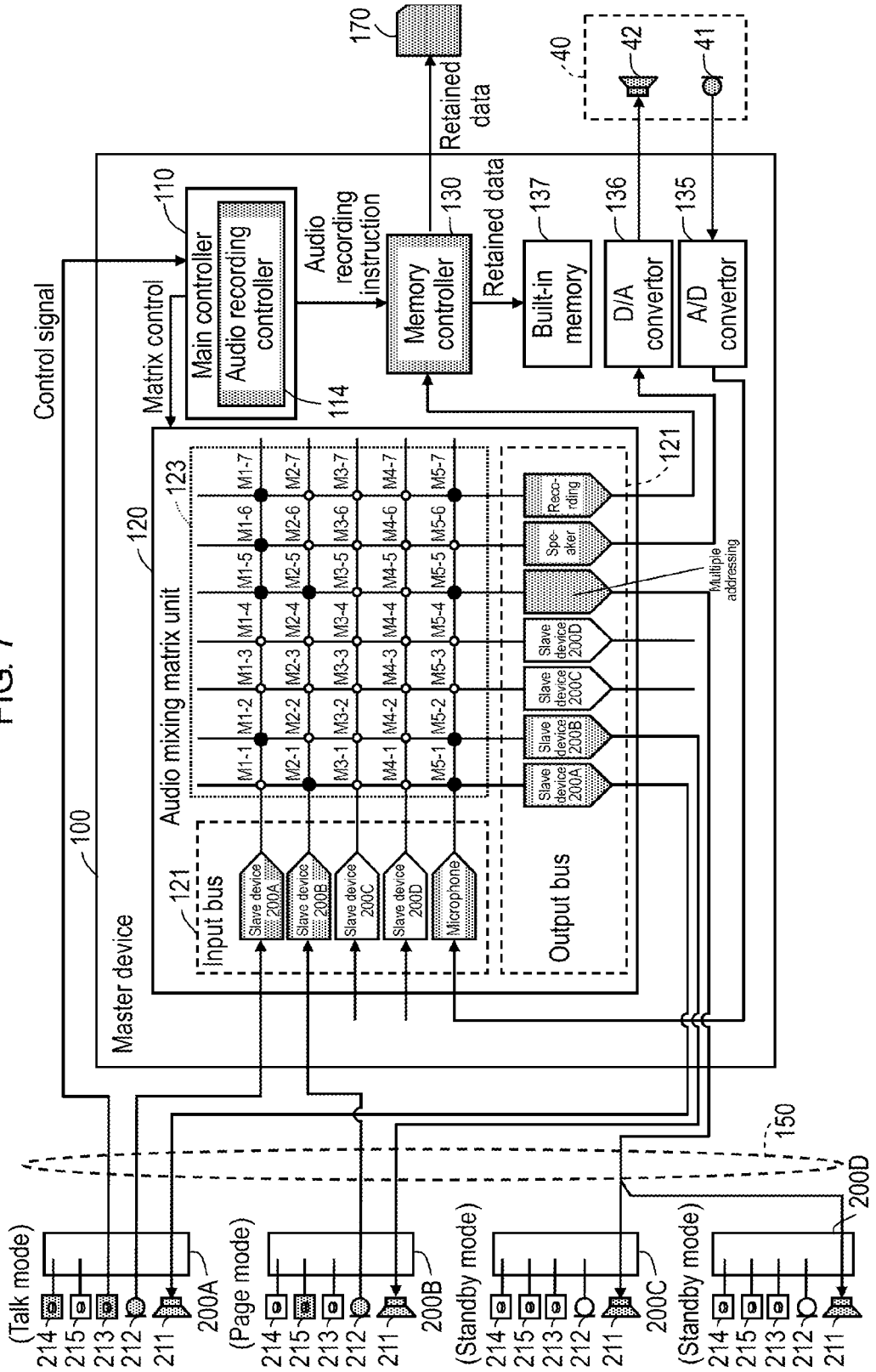

Control signal
Matrix control
Main controller
Audio recording controller
Audio recording instruction
Memory controller
Retained data
Built-in memory
D/A convertor
A/D convertor
Retained data
Audio mixing matrix unit
Input bus
Output bus
Slave device 200A
Slave device 200B
Slave device 200C
Slave device 200D
Microphone
Recording
Speaker
Multiple addressing
Master device
(Talk mode)
(Page mode)
(Standby mode)
(Standby mode)
100
110
114
120
121
123
130
135
136
137
150
170
40
41
42
200A
200B
200C
200D

FIG. 8

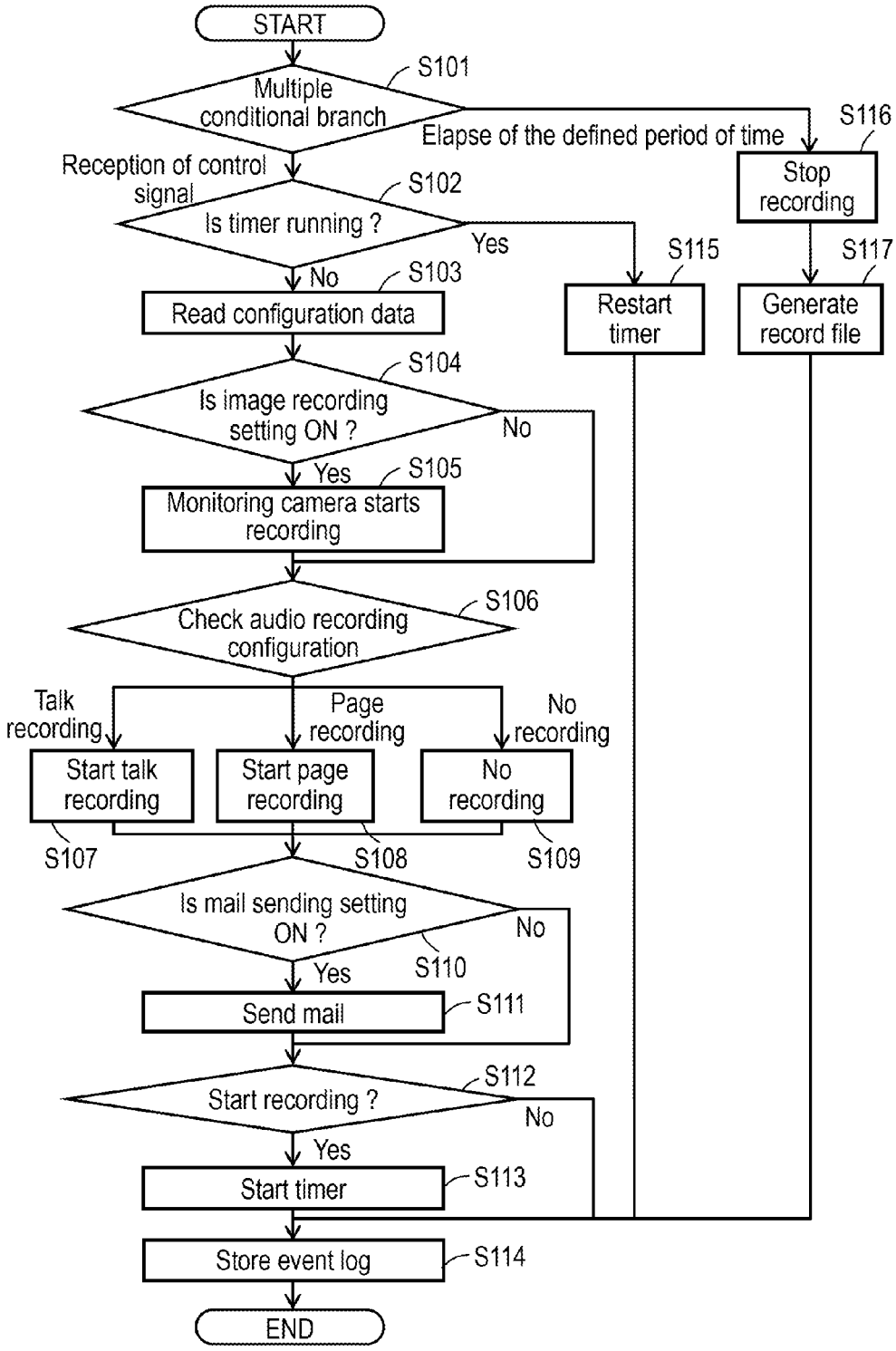
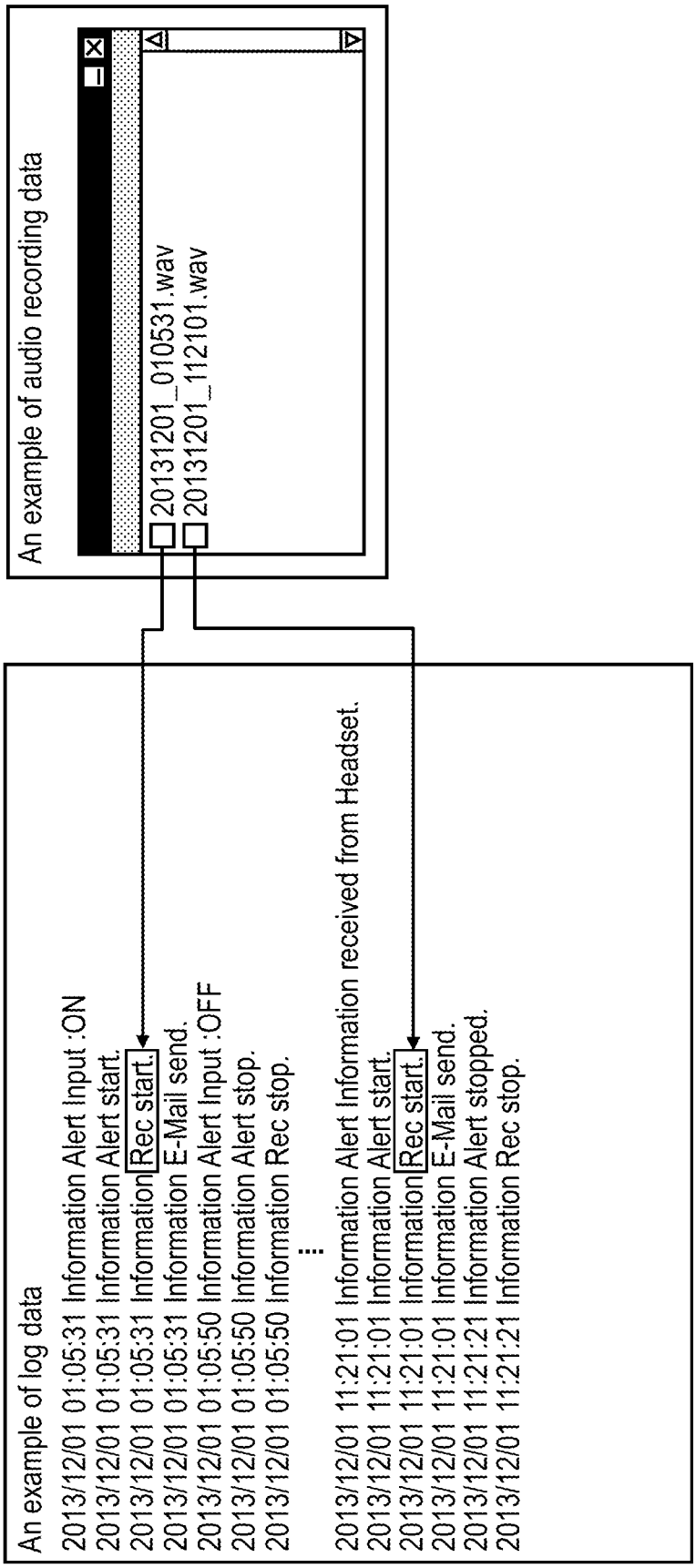

START
S101
Multiple conditional branch
Elapse of the defined period of time
S116
Stop recording
Reception of control signal
S102
Is timer running ?
Yes
S115
Restart timer
S117
Generate record file
No
S103
Read configuration data
S104
Is image recording setting ON ?
No
Yes
S105
Monitoring camera starts recording
S106
Check audio recording configuration
Talk recording
Page recording
No recording
Start talk recording
Start page recording
No recording
S107
S108
S109
Is mail sending setting ON ?
No
Yes
S110
Send mail
S111
S112
Start recording ?
No
Yes
Start timer
S113
Store event log
S114
END

FIG. 9


An example of audio recording data
20131201_010531.wav
20131201_112101.wav
An example of log data
2013/12/01 01:05:31 Information Alert Input :ON
2013/12/01 01:05:31 Information Alert start.
2013/12/01 01:05:31 Information Rec start.
2013/12/01 01:05:31 Information E-Mail send.
2013/12/01 01:05:50 Information Alert Input :OFF
2013/12/01 01:05:50 Information Alert stop.
2013/12/01 01:05:50 Information Rec stop.
2013/12/01 11:21:01 Information Alert Information received from Headset.
2013/12/01 11:21:01 Information Alert start.
2013/12/01 11:21:01 Information Rec start.
2013/12/01 11:21:01 Information E-Mail send.
2013/12/01 11:21:21 Information Alert stopped.
2013/12/01 11:21:21 Information Rec stop.

WIRELESS COMMUNICATION APPARATUS, WIRELESS COMMUNICATION SYSTEM, AND DATA PROCESSING METHOD

BACKGROUND

The present invention relates to a wireless communication apparatus, a wireless communication system and a data processing method of the wireless communication apparatus.

An intercom system is known as intra-office audio communication equipment, which is not connected to a public telephone network. The intercom system facilitates a business process in various situations that use hands-free interactive communication.

JP-A-2012-124546 describes a wireless communication system, as an intercom system, which includes a master device and a plurality of slave devices, wherein a transmitting side of a slave device and a receiving side of a slave device wirelessly communicate with each other via the master device. In this wireless communication system, communication by some of the plurality of slave devices is prioritized. The rest of the plurality of slave devices, however, can still perform communication even though communication by some of the plurality of slave devices is prioritized.

JP-A-2013-137755 discloses an order receiving system which starts to prepare a product or a service to be provided to customers according to prescribed timing.

WO 2011/102141 discloses a system which includes a plurality of order receiving devices and an audio communication control device which communicates with each of the plurality of order receiving devices. In this system, an order receiving device notifies the audio communication control device of an event occurrence. The audio communication control device notified of the event occurrence sends a notice of the event occurrence to a certain order receiving device that is selected from the plurality of order receiving devices in advance.

However, in the intercom system of JP-A-2012-124546, JP-A-2012-124546, and WO 2011/102141, it was difficult to confirm a content of past conversation that took place among a plurality of wireless slave devices of the intercom system.

SUMMARY

According to one aspect of the present invention, a wireless communication apparatus, a wireless communication system and a data processing method of the wireless communication apparatus are provided, which may enable to confirm audio which is picked up by a plurality of devices in the past easily.

According to one embodiment, a wireless communication apparatus which communicates with a first microphone comprises an audio processor which acquires audio data from the first microphone and a controller which detects an instruction for audio recording from the first microphone. Also, the wireless communication apparatus comprises an audio recorder which starts recording the audio data from the first microphone acquired by the audio processor according to the instruction for audio recording and stops the recording after a defined period of time since detection of the instruction for audio recording, and a timer which starts measuring time when the audio recorder starts the recording for the defined period of time. Further, the wireless communication apparatus comprises a memory controller which creates a recorded audio file including the audio data recorded by the audio recorder, wherein the recorded audio file is linked to log information of communication between the wireless communication apparatus and the first microphone.

According to another aspect of the present invention, a system comprises a wireless communication apparatus and a wireless communicator, which communicate with each other. The wireless communicator communicates with a first microphone. The wireless communicator includes an actuator which, when activated, instructs start of audio recording and a transmitter which transmits control data including information that the actuator is activated to instruct start of the audio recording. The wireless communication apparatus includes an audio processor which acquires audio data from the first microphone, a receiver which receives the control data from the wireless communicator, and a controller which detects an instruction for audio recording according to the control data. Also, the wireless communicator includes an audio recorder which starts recording the audio data from the first microphone acquired by the audio processor according to the instruction for audio recording and stops recording the audio data after a defined period of time since detection of the instruction for audio recording, a timer which starts measuring time when the audio recorder starts recording the audio data for the defined period of time, and a memory controller which creates a recorded audio file including the audio data recorded by the audio recorder, wherein the recorded audio file is linked to log information of communication between the wireless communication apparatus and the wireless communicator of the first microphone.

According to another aspect of the present invention, a data processing method is provided for operating a wireless communication apparatus which communicates with a first microphone. The method comprises acquiring audio data from the first microphone and detecting an instruction for audio recording from the first microphone. Also the data processing method comprises starting recording the audio data from the first microphone according to the instruction for audio recording, stopping recording the audio data after a defined period of time since detection of the instruction for audio recording, and creating a recorded audio file including the recorded audio data, wherein the recorded audio file is linked to log information of communication between the wireless communication apparatus and the first microphone.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view showing a configuration example of a wireless communication system and an example of a store and its surrounding where the wireless communication system is installed according to an embodiment of the present disclosure.

FIG. **2** is a block diagram showing the configuration of a master device according to an embodiment of the present disclosure.

FIG. **3** is a block diagram showing the configuration of a slave device according to an embodiment of the present disclosure.

FIG. **4** is an outline view showing the configuration of a slave device according to an embodiment of the present disclosure.

FIG. **5** is a schematic view showing a detailed configuration of an audio mixing matrix unit according to an embodiment of the present disclosure.

FIG. **6** is a schematic view showing an example of ON/OFF state at each contact point of an audio mixing matrix in a first condition according to an embodiment of the present disclosure.

FIG. **7** is a schematic view showing an example of ON/OFF state at each contact point of an audio mixing matrix in a second condition according to an embodiment of the present disclosure.

FIG. **8** is a flowchart showing an example of behavior of a main controller of a master device according to an embodiment of the present disclosure.

FIG. **9** is a schematic view showing an example of log data and a recorded audio data file according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

An embodiment of the present invention (hereafter referred to as the "present embodiment") will be described with reference to the accompanying drawings.

FIG. **1** is a schematic view showing a configuration example of a wireless communication system **1000** and an example of a store **10** and its surrounding where the wireless communication system **1000** is installed. In FIG. **1**, an intercom system which is installed at a drive though store **10** is shown as an example of the wireless communication system **1000**. The intercom system is used at, for example, a drive through store, a broadcast station, a concert hall, a multipurpose hall, and a theater.

The store **10** includes, for example, a master device **100**, a slave device **200**, a vehicle detection sensor **30**, an order post **40**, a monitoring camera **50**, an emergency button **60**, a switching hub **70**, a door opening detection sensor **80**, and a delivery port **90**.

The wireless communication system **1000** includes, for example, the master device **100**, the slave device **200**, the vehicle detection sensor **30**, a microphone **41**, a speaker **42**, the monitoring camera **50**, the emergency button **60**, the switching hub **70**, and the door opening detection sensor **80**.

The master device **100** is a communication device which communicates with a plurality of slave devices **200** via a wireless network **150**. The master device **100** communicates with the vehicle detection sensor **30**, the order post **40**, the emergency button **60**, the switching hub **70**, and the door opening detection sensor **80** and collects various information from devices with which the master device **100** communicates.

The master device **100** includes, for example, a built-in LCD **146** and notifies store staff of necessary information via the built-in LCD **146**. The master device **100** may include a microphone and a speaker which are not described in figures. The microphone and the speaker of the master device **100** are connected to the master phone **100** and may be located outside of the master device **100** in a kitchen, for example.

A wireless communication method using the wireless network **150** is, for example, DECT (Digital Enhanced Cordless Telecommunication), wireless LAN (Local Area Network), Bluetooth, or Zigbee.

The slave device **200** is a wireless communicator that communicates with the master device **100**, which is a wireless communication apparatus, via the wireless network **150**. Identification data of each slave device **200** such as DECT ID and MAC address (Media Access Control Address) is registered in the master device **100**. Therefore, the master device **100** can identify each of the plurality of slave devices **200**.

For example, a store clerk is provided with the slave device **200** which is user wearable. Therefore, the slave device **200** may be moved in the inside and the neighborhood of the store.

The vehicle detection sensor **30** is, for example, a publicly known sensor which detects a vehicle **30** with a customer who comes to the store **10**. The vehicle detection sensor **30** detects a vehicle approaching to within a predetermined distance of the vehicle detection sensor **30** and notifies the master device **100** of vehicle detection information.

The order post **40** includes, for example, a menu board which receives an order from the customer, the microphone **41**, and the speaker **42**. The customer talks with the store staff and orders a product by use of the microphone **41** and the speaker **42**. The microphone **41** converts ambient sound to an electrical signal (an audio signal). The speaker **42** outputs, as audio, the electrical signal which is input to the speaker **42** via the master device **100**. The order post **40** is an example of an information input/output apparatus. The order post **40** may turn on the microphone **41** and the speaker **42** when the vehicle detection sensor detects the vehicle **20**. This may serve to save energy.

The monitoring camera **50** records an image of surroundings of the monitoring camera **50**. The image includes, for example, a visual record, a picture, a movie, and a still picture. The monitoring camera **50** may always record the image and transmit the image to the master device **100** via the switching hub **70**. This may enable to monitor the inside and the neighborhood of the store **10**. The monitoring camera **50** or the master device **100** may perform prescribed image recognition of the image which is recorded by the monitoring camera **50**, and an event may be detected according to a result of the image recognition.

The monitoring camera **50** may link to other sensors such as the vehicle detection sensor **30** and the door opening detection sensor **80** and records the image of the surroundings of the monitoring camera **50**. For example, when the vehicle detection sensor **30** which is located in the vicinity of the order post **40** detects the vehicle **20**, the monitoring camera **50** which is located in the vicinity of the order post **40** may start recording the image. Such arrangement allows for recording images at predetermined timing, to thereby reduce the size of the recorded images.

The emergency button **60** may be located inside or around the store **10**, but the place of installation is not limited to it. The emergency button **60** is pressed, for example, when the store staff or other people think an emergency has arisen, to notify the master device **100** of emergency information which includes that the emergency button is pressed. The emergency button **60** is an example of an actuator which is coupled to the master device **100**. However the emergency button **60** may be integrated or not integrated with the master device **100**.

The switching hub **70** communicates with a plurality of monitoring cameras **50** and supports data communication between the master device **100** and each of the monitoring cameras **50**.

The door opening detection sensor **80** is a publicly known sensor that detects whether the door located in the store **10** is open or closed or an opening state of the door located in the store **10**. The door opening detection sensor **80** may be provided at each of the doors or at only particular one or more doors. The door opening detection sensor **80** detects that the door is opened and that a predetermined period of

time passes after the door is opened, and then the door opening detection sensor **80** notifies the main device **100** of the door opening information. The delivery port **90** is a place where the store staff hand products to the customer.

In short, the customer in the vehicle **20** talks with the store clerk provided with the slave device **200** in the store **10** and orders the product by use of the microphone **41** and the speaker **42** at the order post **40**. The store clerk who receives the order or another store clerk who hears the customer ordering via the slave device **200** prepares the ordered product, for example, in the kitchen and brings the product to the delivery port **90**. After having placed an order, the customer in the vehicle **20** moves the vehicle **20** to the delivery port **90** along a lane and receives the ordered product at the delivery port **90**.

FIG. **2** is a block diagram showing the configuration of a master device.

The master device **100** includes a main controller **110**, an audio mixing matrix unit **120**, a wireless controller **131**, a modulator **132**, a demodulator **133**, a control signal detector **134**, an A/D converter **135**, a D/A converter **136**, and a built-in memory **137**. Also, the master device **100** includes a network controller **138**, a control signal detector **139**, a mail sending controller **141**, an image decoder **142**, a built-in RTC (Real Time Clock) **143**, and a time controller **144**. Furthermore, the master device **100** includes a display controller **145**, a built-in LCD **146**, and an external display device controller **147**.

The master device **100** may include a display **160**, an external memory **170**, an antenna **180**, and an Email server **190**. The display **160** and the antenna **180** may be provided in the master device **100**.

For example, a CPU of the master device **100** performs various processes of the master device **100**, such as various controls, various setups, and various determinations, by retrieving a program and data from an RAM or an ROM and running the program. These processes include a process of the main controller **110**, the memory controller **130**, the wireless controller **131**, the network controller **138**, the mail sending controller **141**, the display controller **145**, and the external display device controller **147**.

The main controller **110** includes a video recording controller **111**, a configuration data controller **112**, an event log controller **113**, and an audio recording controller **114**.

The main controller **110** transmits, to the audio mixing matrix unit **120**, a matrix control signal according to, for example, control information from the control signal detector **134**. The matrix control signal controls ON/OFF state of each contact point of a matrix unit **123** (shown in FIG. **5**) of the audio mixing matrix unit **120**. Therefore, the main controller **110** functions as a connection controller which determines whether each of the connection points is connected or not connected.

The video recording controller **111** transmits, to the memory controller **130**, an image recording instruction according to the control information which includes an image recording instruction from the control signal detector **134**.

The configuration data controller **112** transmits, for example to the memory controller **130**, a configuration data if needed. The configuration data includes various configuration data, which is set by the master device **100**, such as network information, schedule information, audio recording configuration information, video recording configuration information, mail sending configuration information, and configuration information for sound pickup or audio output. For example, an administrator may set the configuration data on a setting screen which is displayed on the display **160** via the actuator (not shown in figures) of the master device **100**.

The audio recording configuration information includes configuration information which defines, for example, that audio recording starts when a prescribed event occurs while a talk button **214** of the slave device **200** is pressed, that audio recording starts when a prescribed event occurs while a page button **214** of the slave device **200** is pressed, and that audio recording does not start according to occurrence of events.

The event log controller **113** generates an event log of events which occur at various parts of the master device **100** at prescribed timing and transmits, to the memory controller **130**, a logging instruction as necessary. The events includes, for example, an event from outside such as receiving a control signal from the slave device **200**, an event occurred inside the master device such as that the main controller **110** sets an operation configuration when the master device **100** receives a control signal.

The audio recording controller **114** transmits, to the memory controller **130**, an audio recording instruction according to the control information which includes an audio recording instruction from the main controller **110**.

The audio mixing matrix unit **120** receives audio data from the demodulator **133** and outputs the audio data to at least one of the D/C convertor **136** and the memory controller **130** according to the ON/OFF state of each of the contact points in the matrix unit **123**.

The audio mixing matrix **120** receives audio data from the A/D convertor **135** and outputs the audio data to at least one of the modulator **132** and the memory controller **130** according to the ON/OFF state of each of the contact points in the matrix unit **123**.

The memory controller **130** receives image data from the image decoder **142** and configuration data from the main controller **110**. Also, the memory controller **130** receives, for example, the image recording instruction, the audio recording instruction, and the logging instruction. The memory controller **130** generates retained data including the image data, the audio data, the log data according to, for example, the image recording instruction, the audio recording instruction, and the logging instruction. And the memory controller **130** stores the retained data in the built-in memory **137** or the external memory **170**. The memory controller **130** may generate a file including the retained data and stores the file in the memory. As described above, the memory controller **130** functions as an audio recorder or an image recorder. Also, the memory controller **130** functions as a file generator which generates a file including the audio recording data according to log information.

The wireless controller **131** controls wireless communication with the slave device **200** via the antenna **180** and the wireless network **150**. The wireless controller **131** transmits, to the antenna **180**, the data from the modulator **132**. The data from the modulator **132** includes audio data. The wireless controller **131** retrieves data which is included in a wireless signal received by the antenna **180** and transmits the data to the demodulator **133**. The data from the antenna **180** includes control data and audio data. The wireless controller **131** functions as a receiver which receives data via the antenna **180**.

The modulator **132** modulates audio data from the audio mixing matrix unit **120** and transmits the audio data to the wireless controller **131**.

The demodulator **133** demodulates the data from the wireless controller **131** and transmits, to the control signal

detector **134**, the control data of the demodulated data and transmits, to the audio mixing matrix unit **120**, the audio data.

The control signal detector **134** receives the control data from the demodulator **133**, generates a control signal by converting the control data, and transmits the control signal to the main controller **110**.

The main controller **110** receives the control signal from the control signal detector **134** and detects occurrence of an event when the control signal includes prescribed information. For example, the main controller **110** detects a prescribed event if the control data includes information that a prescribed button of the slave device **200** is pressed. The prescribed buttons include an audio record button **213**, a talk button **214**, and a page button **215**. The prescribed events include a video record starting event, a talk event, and a page event. Upon detecting any of the prescribed events, audio recording or video recording, for example, is started. In other words, the main controller **110** functions as an audio recording instruction detector and/or a video recording instruction detector.

The A/D convertor **135** receives an analog audio signal which is acquired by the microphone **41** of the order post **40**, converts the analog audio signal to audio data of digital audio signal, and transmits the audio data to the audio mixing matrix unit **120**. The A/D convertor **135** functions as an audio data retrieving unit.

The D/A convertor **136** converts the audio data of the digital audio signal from the audio mixing matrix unit **120** to an analog audio signal, and transmits the analog audio signal to the speaker **42** of the order post **40**. The D/A convertor **136** functions as an audio output unit.

The built-in memory **137** stores the retained data from the memory controller **130** and transmits the retained data to the memory controller **130**. The built-in memory **137** may be a memory which a CPU directly transmits data to/from. The built-in memory **137** may be, for example, ROM (Read Only Memory) and RAM (Random Access Memory).

The network controller **138** controls a network for a wireless communication between the monitoring camera **50** or the Email server **190** and the master device **100**. The network may be, for example, wireless LAN, internet, or other networks.

The network controller **138** receives data from the monitoring camera **50**, transmits the control data of the received data to the control signal detector **139**, and transmits image data of the received data to the image decoder **142**. It means the network controller **138** functions as an image retrieving unit.

The network controller **138** receives mail information from the mail sending controller **141** and sends a mail to the Email server **190** according to the mail information. It means the network controller **138** functions as a mail sending unit.

The control signal detector **139** receives prescribed information from, for example, the vehicle detection sensor **30**, the emergency button **60**, or the door opening detection sensor **80**. Also the control signal detector **139** generates the control signal by converting the prescribed information and transmits the control signal to the main controller **110**.

The main controller **110** receives the control signal from the control signal detector **139** and detects occurrence of an event when the control signal includes prescribed information. For example, the main controller **110** detects an event of vehicle detection when the control signal includes vehicle detection information. For example, the main controller **110** detects an emergency event when the control signal includes emergency information. For example, the main controller **110** detects a door opening event when the control signal includes door opening information. Image recording or video recording starts according to the detection of an event. That is, the main controller **110** functions as an audio recording instruction detector and a video recording instruction detector.

When the mail sending controller **141** receives a mail sending instruction from the main controller **110**, the mail sending controller **141** generates mail information and transmits the mail information to the network controller **138**. The mail information includes, for example, mail text, a mail header, and information of mail destination. The mail text may include information on detection of a prescribed event such as a warning event.

The mail information may include an attached file. The attached file may include a file of the retained data such as the audio recording data or the video recording data which is generated by the memory controller **130**.

The image decoder **142** decodes the image data from the network controller **138** and transmits, to the display controller **145** and the memory controller **130**, the image data which is decoded.

The built-in RTC **143** is, for example, a chip which has a timing function and which is mounted on a circuit board of the master device **100**. The built-in RTC **143** may function as a timer.

The time controller **144** retrieves the time information which is obtained by use of the timing function of the built-in RTC **143**, and transmits the time information to the main control **110** and the display **145**. Also, the time controller **144** checks a condition of timing of the built-in RTC **143**. The time controller **144** does time measuring from a defined point of time.

The display controller **145** performs display control of the built-in LCD **146** or the display **160**.

The built-in LCD **146** displays various information such as image information and literal information. For example, the built-in LCD **146** shows, to people around the master device **100** such as the store clerk wearing the slave device **200**, that the wireless communication system **1000** is in a prescribed state and that the wireless communication system **1000** received a prescribed notice by lighting or blinking a screen or a character on the screen, or turning off the light of the screen or the character on the screen.

The external display device controller **147** performs various control of the display **160**.

The display **160** displays various information such as image information and text information. The image information includes, for example, information of image which is recorded by the monitoring camera.

The external memory **170** is a memory which may be connected and/or inserted to the master device **100**. The external memory **170** may be a HDD (Hard Disk Drive), a SSD (Solid State Drive), various mediums such as a DVD (Digital Versatile Disc), and a SD card.

FIG. **3** is a block diagram showing the configuration of a slave device **200**. The slave device **200** includes a wireless controller **201**, a modulator **202**, a demodulator **203**, an audio controller **204**, an A/D convertor **205**, a D/A convertor **206**, a control signal detector **207**, and a call controller **208**.

The slave device **200** may include a speaker **211**, a microphone **212**, an audio record button **213**, a talk button **214**, a page button **215**, and an antenna **216**. The speaker **211**, the microphone **212**, the audio record button **213**, the talk button **214**, the page button **215**, and the antenna **216** may be located outside the slave device **200** and connected to the slave device **200**.

For example, a CPU of the slave device **200** retrieves a program and data from a RAM or a ROM and performs various processes of the slave device **200**, such as various controls, various setups, and various determinations, by running the program. These processes include, for example, a process of the wireless controller **201**, the audio controller **204**, and the call controller **208**.

The wireless controller **201** controls wireless communication with the master device **100** via the antenna **216** and the wireless network **150**. The wireless control **201** transmits, to the antenna **216**, data from the modulator **202**. The data from the modulator **202** includes, for example, control data and audio data. The wireless controller **201** transmits, to the demodulator **203**, data which is received by the antenna **216**. The data from the antenna **216**, for example, includes the control data and the audio data. The wireless controller **201** functions as a transmission unit which transmits data via the antenna **216**.

The modulator **202** modulates the audio data from the audio controller **204** and the control data from the call controller **208**, and transmits the modulated data to the wireless controller **201**.

The demodulator **203** demodulates the data from the wireless controller **201**, transmits, to the call controller **208**, the control data of the demodulated data, and transmits, to the audio controller **204**, the audio data of the demodulated data.

The audio controller **204** receives the audio data from the A/D convertor **205** and outputs, to the modulator **202**, the audio data according to an audio control signal from the call control **208**. The audio controller **204** receives the audio data from the demodulator **203** and outputs the audio data to the D/A converter **136** according to the audio control signal from the call controller **208**.

The A/D converter **205** receives an analog audio signal acquired by the microphone **212**, converts the analog audio signal to audio data which is a digital audio signal, and transmits the audio data to the audio controller **204**.

The D/A converter **206** converts the audio data which is a digital audio signal from the audio controller **204** to an analog audio signal, and transmits the analog audio signal to the speaker **211**.

The control signal detector **207** transmits the control data to the call controller **208** when the control signal detector **207** detects a prescribed operation such as pressing of the audio record button **213**, the talk button **214**, or the page button **215**. The control signal detector **207** detects that a state of each button transits to ON state, but each of the buttons does not need to be pressed. The control information includes information of which button is pressed.

The call controller **208** receives the control data from the demodulator **203** and the control data from the control signal detector **207**. The call controller **208** generates audio control signal according to the received control data and transmits the audio control signal to the audio controller **204**. The call controller **208** transmits, to the modulator **202**, the control data from the control signal detector **207**.

For example, the call controller **208** generates the audio control signal which instructs to transmit, to the modulator **202**, the audio data from the microphone **212** when the control data from the control signal detector **207** includes information that the talk button **214** or the page button **215** is pressed.

On the other hand, the call controller **208** does not generate the audio control signal which instructs to transmit, to the modulator **202**, the audio data from the microphone **212** when the call controller **208** does not receive the control data including information that the talk button **214** or the page button **215** is pressed.

Therefore, the audio data is transmitted from the slave device **200** when the talk button **214** or the page button is pressed, for example.

The speaker **211** outputs the analog audio signal from the D/A converter **206** as a sound. The microphone **212** converts ambient sound to an electrical signal (an audio signal).

The audio record button **213** is for starting to record conversations among a plurality of store staff and between the customer and the store clerk. For example, the master device **100** starts recording when the audio record button **213** is pressed. The master device **100** stops recording after a defined period of time from when the audio record button **213** is pressed. Also, if the audio record button **213** is pressed again within the defined period of time from when the audio record button **213** is firstly pressed, the measurement time is reset. And the master device **100** keeps recording for the defined period of time re-set to start from when the audio record button **213** is pressed again.

For example, if any dispute arises between the store clerk and the customer, a conversation between the store clerk and the customer can be easily recorded immediately after the store clerk presses the audio record button **213**. Also, the master device **100** does not stop recording even when the audio record button is pressed again before the defined period of time passes from when the audio record button **213** is firstly pressed. Therefore, it may avoid failing to record a necessary conversation. Not only audio recording but also video recording may be started by pressing of the audio record button **213**.

The talk button **214** is for starting a conversation with the customer. For example, the slave device **200** whose button is pressed communicates with the order post **40** when the talk button **214** is pressed. In this case, the microphone **212** and the speaker **211** of the slave device **200**, whose talk button **214** is pressed, electrically connect to the microphone **41** and the speaker **42** of the order post **40**. Therefore the store clerk wearing the slave device **200** whose button is pressed can talk with the customer.

The page button **215** is for starting a conversation among the store staff each wearing the slave device **200**. For example, the slave device **200** whose page button **215** is pressed communicates with all of other slave devices **200** when the page button **215** is pressed (broadcast communication). In this case, the microphone **212** and the speaker **211** of the slave device **200** whose page button **215** is pressed electrically connect to the microphone **212** and the speaker **211** of all of other slave devices **200**. On the other hand, the slave device **200** whose page button **215** is pressed does not communicate with the order post **40**. Therefore, the store staff can talk to each other but the customer does not listen to the conversation.

The audio record button **213**, the talk button **214**, and the page button **215** may function as described above. However these functions may be appropriately selected by changing the functions of each of the buttons according to a setting of the master device **100**. Also the store staff may talk to not only the customer but also other store staff when the talk button **214** is pressed.

Next is an explanation of a sample outline view of the slave device **200**.

FIG. **4** is an outline view showing the configuration of the slave device **200**. In FIG. **4**, a headset-type slave device **200** is described. However other configurations such as a configuration which is worn around the hips are applicable. In

FIG. **4**, the slave device **200** includes the speaker **211**, the microphone **212**, the audio record button **213**, the talk button **214**, the page button **215**, and volume adjust button **216**, for example.

Next is an explanation of a configuration of a recording function of the master device **100**.

FIG. **5** is a schematic view showing a detailed configuration of an audio mixing matrix unit **120**. In FIG. **5**, the configuration of the recording function of the master device **100** is also described.

The audio mixing matrix unit **120** includes an input bus **121**, an output bus **122**, and a matrix unit **123**.

The input bus **121** includes, for example, an input channel for the store staff and an input channel for the customer. The input channel for the store staff is an input channel for an audio acquired by each microphone **212** of the plurality of slave device **200**. The input channel for the customer is an input channel for an audio acquired by the microphone **41** of the order post **40**.

The input channel for the store staff includes, for example, an input channel for a slave device **200**A, an input channel for a slave device **200**B, an input channel for a slave device **200**C, and an input channel for a slave device **200**D. The number of the input channel for the store staff may be another number.

The output bus **122** includes an output channel for the store staff, an output channel for the customer, an output channel for multiple addressing, and an output channel for recording. The output channel for the store staff is an output channel for an audio output by each speaker **211** of the plurality of slave devices **200**. The output channel for the customer is an output channel for an audio output by the speaker **42** of the order post **40**.

The output channel for the store staff includes, for example, an output channel for a slave device **200**A, an output channel for a slave device **200**B, an output channel for a slave device **200**C, and an output channel for a slave device **200**D. The number of the output channel for the store staff may be another number.

The output channel for the store staff of the output bus **122** is for transmission (unicast transmission) of the audio signal to one of the plurality of slave devices **200**. The output channel for multiple addressing is for transmission (broadcast transmission) of the audio signal to all of the plurality of slave devices **200**.

The matrix unit **123** includes a plurality of connection points which connects or disconnects one of the input channels of the input bus **121** to or from one of the output channel of the output bus **122**. FIG. **5** illustrates that the plurality of connection points are arranged in a matrix fashion. The matrix unit **123** functions as an input/output connection unit.

In FIG. **5**, the connection point number is referred to as "Mx-y" by use of an input channel number "x" of the input bus **121** and an output channel number "y" of the output bus **122**. For example, the connection point number at the connection point of the input channel of the slave device **200**A and the output channel of the slave device **200**B is referred to as "M1-2".

When each of the connection points electrically connects (ON), the input channel and the output channel communicate with each other and the audio data is transmitted from the input channel to the output channel. On the other hand, when each of the connection points electrically does not connect (OFF), the input channel and the output channel do not communicate with each other and the audio data is not transmitted from the input channel to the output channel.

In FIG. **5-7**, a black circle represents the connection point is connected (ON) and a white circle represents the connection point is disconnected (OFF). Therefore, in FIG. **5**, all of the connection points are disconnected (OFF). In this case, the audio record button **213**, the talk button **214**, and the page button **215** of all of the slave devices **200** are turned off (OFF).

When the connection point is connected (ON), it means the operation of the button is available. When the connection point is disconnected (OFF), it means the operation of the button is not available. For example, the button is turned on when the button is pressed. The button is turned off when the button is pressed again or the defined period of time has passed from when the button is pressed.

FIG. **6** is a schematic view showing a first example of ON/OFF state at each contact point of an audio mixing matrix **120**.

In FIG. **6**, the audio record button **213** and the talk button **214** of the slave device **200**A are in ON state and the page button **2115** of the slave device **200**A is in OFF state. The page button **215** of the slave device **200**B is in ON state and the audio record button **213** and the talk button **214** are in OFF state. Also, the audio record button **213**, the talk button **214**, and the page button **215** of the slave device **200**C and **200**D are in OFF state. In FIG. **6**, the configuration for recording is set to record audio data from the slave device **200** and the microphone **41** according to the state of the talk button **214** and the page button **215**.

Regarding the slave device **200**A, the wireless controller **201** transmits, to the master device **100**, a wireless signal which includes the control signal and the audio signal via the wireless network **150** when the talk button **214** of the slave device **200**A is pressed. The control data includes information that the talk button **214** of the slave device **200**A is pressed. The audio data is acquired by the microphone **212** of the slave device **200**A.

Regarding the master device **100**, the wireless controller **131** receives the wireless signal from the slave device **200**A. The control signal detector **134** generates a control signal from the control data which is included in the control data. The main controller **110** detects that the control signal includes information that the talk button **214** of the slave device **200**A is pressed. The control signal includes an instruction for starting a call between the slave device **200**A and the other slave devices **200**B-**200**D or the order post **40**.

The main controller **110** transmits, to the audio mixing matrix unit **120**, a matrix control signal which corresponds to the control signal when the main controller **110** receives the information that the talk button **214** of the slave device **200** is pressed. In this case, the control signal includes the instruction for starting a call between the slave device **200**A and the other slave devices **200**B-**200**D or the order post **40**.

The audio mixing matrix unit **120** chooses the input channel of the slave device **200**A and the input channel of the microphone **41** as the input channels in order for the store clerk using the slave device **200**A and the customer to talk to each other when the audio mixing matrix unit **120** receives the information that the talk button **214** of the slave device **200**A is pressed. The audio mixing matrix unit **120** chooses the output channel of the slave device **200**A and the output channel for the speaker **42** as the output channels in order for the store clerk using the slave device **200**A and the customer to talk to each other. Also, the audio mixing matrix unit **120** chooses the output channel for multiple addressing as the output channel in order for the store clerk using the slave device **200**A and the customer to listen to their conversation.

When the audio data of the slave device **200**A is output by the speaker **211** of the slave device **200**A, audio howling may occur because of voice of the store clerk using the slave device **200**A and audio output from the speaker **211**. Therefore, in FIG. **6**, the output channel for multiple addressing and the speaker **211** of the slave device **200**A are not electrically connected.

Also, the audio mixing matrix unit **120** exclusively chooses the output channel of each slave device of the output bus **112** separately, such as the output channel of one of the slave devices **200**A-**200**D, and the output channel for multiple addressing. The output channel of individual slave device (the output channel of the slave device **200**A) or the output channel for multiple addressing may be used in order for the speaker **211** of the slave device **200**A to output the audio data from the other device. In this case, the output channel of individual slave device is preferentially selected rather than the output channel for multiple addressing.

In FIG. **6**, the audio mixing matrix unit **120** turns on the connection points M1-5, M1-6, M5-1, and M5-5 according to the above channel selection policy. The connection point M1-5 is the connection point between the input channel of the slave device **200**A and the output channel of multiple addressing. The connection point M1-6 is the connection point between the input channel of the slave device **200**A and the output channel for the speaker **42**. The connection point M5-1 is the connection point between the input channel for the microphone **41** and the output channel of the slave channel **200**A. The connection point M5-5 is the connection point between the input channel for the microphone **41** and the output channel of multiple addressing.

Therefore, the input channel of the slave device **200**A and the output channel of multiple addressing are connected, and the audio data from the demodulator **133** is input to the input channel of the slave device **200**A. The input channel of the microphone **41** and the microphone **41** are connected, and the audio data form the A/D converter **135** is input to the input channel of the microphone **41**. The output channel of the slave device **200**A and the speaker **211** of the slave device **200**A are connected, and the speaker **211** of the slave device **200**A outputs the audio data from the microphone **41**. The output channel of the multiple addressing and the speakers **211** of the slave devices **200**B-**200**D are connected, and the speaker **211** of the slave devices **200**B-**200**D output the audio data from the slave device **200**A and the microphone **41**. The output channel of the speaker **42** and the speaker **42** are connected, and the speaker **42** outputs the audio data from the slave device **200**A.

Regarding the slave device **200**B, the wireless controller **201** transmits, to the master device **100**, the wireless signal which includes the control data and the audio data via the wireless network **150** when the page button **215** of the slave device **200**B is pressed. The control data includes information that the page button **215** of the slave device **200**B is pressed. The audio data is acquired by the microphone **212** of the slave device **200**B. In this case, the page button **215** is pressed after the talk button **214** is pressed, for example.

In the master device **100**, the wireless controller **131** receives the wireless signal from the slave device **200**B. The control signal detector **134** generates the control signal from the control data which includes the wireless signal. The main controller **110** detects that the control signal includes information that the page button **215** of the slave device **200**B is pressed. The control signal includes the instruction for starting a call between the slave device **200**B and the other slave devices **200**A, **200**C, and **200**D.

The main controller **110** transmits, to the audio mixing matrix unit **120**, the matrix control signal which corresponds to the control signal when the main controller **110** receives information that the page button **215** of the slave device **200**B is pressed. In this case, the control signal includes the instruction for starting a call between the slave device **200**B and the other slave devices **200**A, **200**C, and **200**D.

When the audio mixing matrix unit **120** receives information that the page button **215** of the slave device **200**B is pressed, the audio mixing matrix unit **120** adds the input channel of the slave device **200**B as the input channel and adds the output channel of the slave device **200**B as the output channel. Therefore, the store clerk using the slave device **200**B can talk with the other store clerks using the other slave devices **200**A, **200**C, and **200**D.

When the audio data of the slave device **200**B is output by the speaker **211** of the slave device **200**B, audio howling may occur because of voice of the store clerk using the slave device **200**B and audio output from the speaker **211**. Therefore, the output channel for multiple addressing and the speaker **211** of the slave device **200**B are not electrically connected.

The audio mixing matrix unit **120**, furthermore, turns on the connection points M1-2, M2-1, and M2-5 according to the above channel selection policy in FIG. **6**. The connection point M1-2 is the connection point between the input channel of the slave device **200**A and the output channel of the slave device **200**B. The connection point M2-1 is the connection point between the input channel of the slave device **200**B and the output channel of the slave device **200**A. The connection point M2-5 is the connection point between the input channel for the slave device **200**B and the output channel of multiple addressing.

Therefore, the input channel of the slave device **200**B and the microphone **212** of the slave device **200**B are connected, and the audio data from the demodulator **133** is input to the input channel of the slave device **200**B. The speaker **211** of the slave device **200**A outputs the audio data from the slave device **200** and the microphone **41**. The output channel of the slave device **200**B and the speaker **211** of the slave device **200**B are connected, and the speaker **211** of the slave device **200**B outputs the audio data from the slave device **200**A and the microphone **41**. The output channel of the multiple addressing and the speakers **211** of the slave devices **211**C and **200**D are connected, and the speaker **211** of the slave devices **200**C and **200**D output the audio data from the slave devices **200**A and **200**B and the microphone **41**.

Also, in the slave device **200**A, the wireless controller **201** transmits, to the master device **100**, the wireless signal which includes the control signal via the wireless network **150** when the audio record button **213** of the slave device **200**A is pressed. The control data includes information that the audio record button **213** of the slave device **200**A is pressed.

In the master device **100**, the wireless controller **131** receives the wireless signal from the slave device **200**A. The control signal detector **134** generates the control signal from the control data which is included in the wireless signal. The main controller **110** transmits the control signal to the main controller **110** when the main controller **110** detects the information that the audio record button **213** is pressed. The control signal includes a recording instruction to the slave device **200**A.

The main controller **110** transmits, to the audio mixing matrix unit **120**, a matrix control signal according to the control signal when the main controller **110** receives the

information that the audio record button **213** is pressed. In this case, the connection points M1-7, M2-7, and M5-7, which are the connection points between the input channels connected to any of the output channels and the audio record channel, are turned ON because the control signal includes the recording instruction.

The connection point M1-7 is the connection point between the input channel of the slave device **200**A and the output channel for recording. The connection point M2-7 is the connection point between the input channel of the slave device **200**B and the output channel for recording. The connection point M5-7 is the connection point between the input channel of the microphone **41** and the output channel for recording.

Therefore, the output channel for recording and the memory controller **130** are connected, and the audio data from the slave devices **200**A and **200**B and the microphone **41** is output to the memory controller **130**. Therefore, the built-in memory **137** or the external memory **170** may store the retained data which includes the audio data from the slave devices **200**A and **200**B and the microphone **41**.

In the first example described in FIG. **6**, the audio data from the slave devices **200**A and **200**B and the order post **40** may be recorded according to the configuration for recording and the slave device **200** whose talk button **214** or page button **215** is in ON state. Thus, the conversation between the store clerk and the customer and the conversation among the store staff may be recorded. Also, the customer does not hear the conversation among the store staff. This protects the store's privacy.

FIG. **6** shows the audio data is recorded via one output channel for recording. However a plurality of the output channels may be assigned to each of the slave devices **200**A-**200**D and the microphone **41**. This may enable to check the content of the audio data of each person easily because each of the recorded data corresponds to one input channel.

FIG. **6** shows the audio data is output by use of the output channel of multiple addressing when the talk button **214** or the page button **215** is pressed. However, the mail controller **110** may designate each of the output channels of the slave devices **200**A-**200**B separately. This may enable to output only the necessary audio data. Therefore, efficiency may be improved and privacy may be protected.

FIG. **7** is a schematic view showing a second example of ON/OFF state at each contact point of the audio mixing matrix **120**.

In FIG. **7**, The ON/OFF state of the audio record button **213**, the talk button **214**, and the page button **215** of the slave devices **200**A-**200**D are the same as in FIG. **6**. However, information of the configuration for recording in FIG. **7** is different from that in FIG. **6**. In FIG. **7**, the configuration for recording is that audio data from the slave device **200** and the microphone **41** is recorded according to the ON/OFF state of the talk button **214** and that audio data from the slave device **200** is not recorded according to the ON/OFF state of the page button **215**.

The different point from the first example of FIG. **6** is that the connection point M2-7 of the audio mixing matrix unit **120** of the master device **100** is not in ON state, although the ON/OFF state of each of all buttons of the slave devices **200**A-**200**D is the same as in FIG. **6**. In other words, in the first example of FIG. **6**, the audio mixing matrix unit **120** records the audio data from the slave device **200**B whose page button **215** is pressed. However the audio mixing matrix unit **120** does not record the audio data from the slave device **200**B whose page button **215** is pressed in the second example of FIG. **7**.

In the second example shown in FIG. **7**, the audio data from the slave device **200**A and the order post **40** is recorded according to the configuration of recording and the slave device **200** whose talk button **214** or page button **215** is ON state. This may enable to record the audio data of the store clerk using the slave device **200**A whose talk button **214** is pressed and the customer. Also the audio data from the store clerk using the slave device **200**B whose page button **215** is pressed is not recorded. Also, the customer does not hear the conversation among the store staff. This protects the store's privacy.

Next is an explanation of behavior of the master device **100**.

FIG. **8** is a flowchart showing an example of behavior of a main controller.

Firstly, the main controller **110** determines whether a plurality of conditions are met or not (S**101**). The plurality of conditions include whether the main controller **110** receives the control signal from the control signal detector **134** or the control signal detector **139** or not and whether a trigger for stopping audio or video recording is generated or not.

Here, the flowchart of the control signal relating to audio recording, video recording, and mail sending from the slave device **200** is explained. The control signal, which is just logged, not relating to audio recording, video recording, and mail sending, such as the control signal detected by the vehicle detection sensor **30** to only indicate that the customer comes to the store, is not explained here.

The control signal is received when, for example, a prescribed event occurs to the slave device **200** or external connected devices such as the vehicle detection sensor **30**, the emergency button **60**, and the door opening detection sensor **80**. The trigger for stopping the audio/video recording may be an instruction for stopping the audio recording and the video recording or a fact that the defined period of time has elapsed. The main controller **110** may determine whether the defined period of time has elapsed or not based on the time information notified from the time controller **144** which monitors the built-in RTC **143**.

The main controller **110** determines whether a timer is running or not when the main control **110** receives the control signal (S**102**). The timer is for determining an ending time of the audio/video recording.

When the timer is not running, the main controller **110** reads the configuration data relating to the audio/video recording and the mail sending, from, for example, the built-in memory **137** (S**103**). The configuration data includes, for example, information of the configuration for audio recording, video recording, and mail sending which is included in the configuration data.

The main controller **110** refers to configuration information of audio recording, which is included in the loaded configuration data. Then the main controller **110** checks the content of the configuration data for recording, such as whether audio and/or video recording is configured (S**104**).

When video recording is configured, the video recording controller **111** starts recording the image which is taken by the monitoring camera **50** (S**105**). In this case, the video recording controller **111** of the main controller **110** transmits an instruction for image recording to the memory controller **130**. The memory controller **130** records the image from the

image decoder **142** into the built-in memory **137** or the external memory **170** according to the instruction for image recording.

The recorded images may be images from all of the monitoring cameras **50** of the wireless communication system **1000**. In this case, when the store clerk wearing the slave device **200**, which has any pressed button, moves around in the store **10**, the store clerk is likely to be in the recorded image. Also, when the door opening detection sensor **80** detects that the door is opened, there may be a suspicious individual in the store **10**. When the suspicious individual moves around in the store **10**, the suspicious individual is likely to be in the recorded image. Therefore, security of the store **10** may be improved.

Also, the recorded image may be images from at least one of the monitoring cameras **50** of the wireless communication system **1000**. For example, when the vehicle detection sensor **30** detects the vehicle, there is likely to be a customer. Then, the image recorded by one or a plurality of monitoring cameras **50** arranged around the order post **40** may be recorded. This may lead to recording a dispute between the staff and the customer during their conversation and the recorded video can be later verified. Therefore, security of the store **10** may be improved. The one or the plurality of monitoring cameras **50** which are recording may be identified by, for example, identification data, such as an IP address and MAC address of the monitoring camera **50**.

On the other hand, the video recording controller **111** does not start recording the image which is taken by the monitoring camera **50** when the configuration for recording is a no-recording configuration.

The main controller **110** refers to information of the configuration for audio recording which is included in the loaded configuration data and reads the content of the configuration for audio recording (S**106**).

When the configuration for audio recording is such as to start recording when the talk button **214** is pressed, the audio recording controller **114** starts recording (talk recording) according to the fact that the talk button **214** is pressed (S**107**). In this case, the audio recording controller **114** of the main controller **110** transmits, to the memory controller **130**, an instruction for audio recording. The memory controller **130** stores the audio data from the audio mixing matrix unit **120** to the built-in memory **137** or the external memory **170** according to the instruction for audio recording.

Whether audio data of the slave device **200** is recorded depends on, for example, which slave device has the pressed talk button **214**. The audio data from the microphone **41** may be recorded. For example, the audio data which is to be recorded in FIGS. **6** and **7** is recorded.

When the configuration for audio recording is such as to start recording when the page button **215** is pressed, the audio recording controller **114** of the main controller **110** starts recording (page recording) according to the fact that the page button **214** is pressed (S**108**). In this case, the audio recording controller **114** of the main controller **110** transmits, to the memory controller **130**, an instruction for audio recording. The memory controller **130** stores the audio data from the audio mixing matrix unit **120** to the built-in memory **137** or the external memory **170** according to the instruction for audio recording.

The audio data which is to be recorded of the slave device **200** depends on, for example, which slave device has the pressed page button **215**. The audio data from the microphone **41** is not recorded. For example, the audio data which is to be recorded in FIG. **6** is recorded.

When the configuration for audio recording is set so as not to record, the audio recording controller **114** of the main controller **110** does not start recording (S**109**).

The main controller **110** refers to information of the mail sending configuration which is included in the loaded configuration data and reads the content of the mail sending configuration. For example, the main controller **110** determines whether the mail sending configuration is a configuration for a mail sending (S**110**).

When the mail sending configuration is such as to send a mail, the mail controller **110** notifies the mail sending instruction to the mail sending controller **141** (S**111**). The mail sending controller **141** sends a mail to the mail server **190** in order to notify, by mail, the receiver that a prescribed event occurs, via the network controller **138**. The recorded audio data and/or the recorded video data may be attached to the mail.

On the other hand, when the mail sending configuration is set so as to not send a mail, the main controller **110** does not notify the mail sending instruction.

The processing order which includes the three configuration process for video recording at S**104** and S**105**, the configuration process for audio recording at S**106**-S**109**, and the configuration process for mail sending at S**110** and S**111** may be changed.

The main controller **110** determines whether the video recording process and/or the audio recording process started or not (S**112**). That is, for example, the main controller **110** determines whether the main controller **110** implemented any of the process of S**105**, S**107**, and S**108**.

When the main controller **110** starts recording audio and/or recording video, the main controller **110** starts the timer (S**113**).

The event log controller **113** of the main controller **110** stores the event log (S**114**). In this case, the event log controller **113** of the main controller **110** transmits a logging instruction to the memory controller **130**. The memory controller **130** stores information of the event log to the built-in memory **137** or the external memory **170**. In S**113**, the event log "Rec Start" shown in FIG. **9** is stored, for example.

In S**102**, the main controller **110** restarts the timer when the timer is running (S**115**). For example, assuming that the audio recording button **213** is pressed again within the defined period of time (e.g. two minutes) from when the audio recording button **213** of the slave device **200** is initially pressed. In this case, the timer is restarted when the audio recording button **213** is pressed again. Therefore, the audio recording time and/or the video recording time may be extended up to the maximum recording time (e.g. five minutes) if needed.

Generally, the store clerk may not see the audio record button **213** and other buttons when the slave device **200** is a headset. Therefore, if a recording system is such that the store clerk starts and stops recording audio by operating the audio recording button **213**, the store clerk may fail to properly record audio by accidentally pressing the audio recording button **213** to stop an on-going recording. However, according to the examples of the present invention as described above, the store clerk may record audio without any difficulty even when the store staff presses the audio record button **213** twice. This is because the audio recording stops only after the defined period of time from when the audio record button **213** is pressed.

The process proceeds from S**115** to S**114**.

In S**102**, the audio recording controller **114** and/or the video recording controller **111** stop recording when the main

controller **110** detects an instruction for stopping the audio recording and/or the video recording or a fact that the defined period of time has elapsed. In this case, the audio recording controller **114** gives an instruction for stopping the audio recording to the memory controller **130**. Additionally or alternatively the video recording controller **111** gives an instruction for stopping the video recording to the memory controller **130**.

Also, the main controller **110** transmits the matrix control signal to the audio mixing matrix unit **120** when the main controller **110** stops the audio recording. The matrix control signal includes a signal for turning off the connection point between the output channel for recording and the input channel which is to be recorded.

Then the main controller **110** generates an audio record file and/or a video record file (S**117**). In this case, the audio recording controller **114** and/or the video recording controller **111** give an instruction for creating a file to the memory controller **130**. The memory controller **130** creates the audio data and/or the video data from the recording start time to the recording stop time as single file, for example. The memory controller **130** generates the audio record file and/or the video record file according to the event log information stored in S**114**.

The main controller **110** records data relating to the log information. For example, the main controller **110** may name the audio record file or the video record file using "time and date of the event" as a file name. Also, the main controller **110** may include a link of the file to the event log data. Specially, when the slave device **200** is operated, the main controller **110** generates a file which links to the event log of the slave device **200**. Information of the link of the file may be URL (Uniform Resource Locator). URL is an example of address information which enables to access the audio record file.

The process proceeds from S**117** to S**114**.

The processes S**101**-S**114** are iteratively implemented as long as a prescribed iteration condition is satisfied. The prescribed iteration condition may be a maximum number of executions or a time period of execution. The prescribed iteration need not be set. The processes may be iteratively implemented, or not iteratively implemented.

In the above example of behavior on the main controller **110**, a dispute between the staff and a customer and other events inside/outside the store **10**, such as unexpected situations, are recorded as audio and/or video. This may ensure security. Aldo, the main controller **110** does not always record. This may lead to protect privacy of the customer and/or the store staff.

FIG. **8** shows that the configuration for audio recording is set so as to link to either of the talk button **214** and the page button **215** (S**107** and S**108**). However the configuration for audio recording may be set to link to both of the talk button **214** and the page button **215**.

Next is an explanation of the log data format and the audio record file format.

FIG. **9** is a schematic view showing an example of log data and a recorded audio data file.

The log data is a data set which includes event log information of the master device **100**. The log data includes, for example, time and date of each event such as years, months, days, hours, minutes, and seconds, and information of the type of each event. The information of type of event may be information relating to the fact that the emergency button **60** is pressed, that audio recording starts, that video recording starts, that audio recording stops, that video recording stops, that the master device **100** receives a warning from the slave device **200** which may be in a handset shape, that a mail is sent, and the configuration of the master device **100** is changed (e.g. the configuration for audio/video recording is changed by a control signal). The time of the event occurrence is the same as the time of the audio recording instruction.

The main controller **110** may refer to time information of the log data and include the time information of the log data to the file name of the audio record file when the main controller **110** generates the audio record file. This is for a user's convenience because, for example, many steps to input the file name by the administrator or the user of the wireless communication system **1000** may be avoided. Also, the log data and the file name are linked to each other because the file name of the audio record file includes at least a part of the log data. This helps a user to compare the log data to the file name and manage files easily.

In FIG. **9**, the recorded audio data file is explained as an example, but the above explanation is applicable to the recorded video data.

Next is an explanation of a backup of the wireless communication system **1000**.

The configuration data controller **112** of the main controller **110** may back up a system construction (the configuration data) collectively and perform control for restoring. The system construction may include various configuration information of the wireless communication system **1000**. The system construction includes, for example, the configuration data of the schedule, the sound environment, and the behavior of the wireless communication system **1000** at the time of event occurrence, such as the time of audio recording, the time of video recording and the time of mail sending. The main controller **110** may back up or restore it in the external memory **170** such as a SD card.

If there are a plurality of stores **10**, by backing up and/or restoring the system configuration, the system construction of the store **10** where the wireless network system **1000** is installed is easily duplicated to the wireless communication system of the other store. For example, the operation to change the time, from 10:30 to 11:00, to send to the store staff in the plurality of stores an audio message "check cash registers," which is common in the plurality of stores, is simplified. Also, this simplifies the operation to change a seasonal greeting message, which introduces a recommended product to the customer and is output from the speaker **42** when the new customer is detected, in the plurality of stores together.

Therefore, for example, an owner who runs a plurality of stores may easily change the system configuration of the plurality of stores together. Also, when the master device **100** crashes, the system configuration of the broken master device **100** may be easily restored to a newly installed master device **100** via the external memory **170**.

Next is an explanation of the configuration of the wireless communication system **1000**.

FIG. **1** shows the wireless communication system **1000** including the one master device **100** and the plurality of slave devices **200**. However the wireless communication system may include a plurality of master devices and the plurality of slave devices. In this case, the plurality of master devices **100** may link to the one slave device **200**.

In this wireless communication system, the slave device **200** registers the plurality of master devices **100**. Registration information of the plurality of master devices may be stored in a memory of the slave device **200**. The memory of the slave device **200** is not shown in figures. The registration information may include identification data of the master

device **100** such as DECT ID, IP address, and MAC address. The slave device **200** may detect a prescribed operation, which may be that a search button is pressed, by use of an actuator of the slave device **200**. The actuator of the slave device **200** is not shown in figures. Then the slave device **200** refers to the registration information of the master device **100** and searches in the closest master device **100** to the slave device **200** among the master devices **100**. The closest master device **100** may be the master device **100** whose reception level detected by the slave device **200** is the highest.

This may lead to establishing a communication session with the searched master device **100** without deleting the registration information of a pre-registered master device **100**. Therefore, when the slave device **200**, which was used at the store A, is used at the store B, the slave device **200** may be continuously used easily without having to perform a particular registering operation of the master device **100** while moving between the stores. For example, the slave device **200** of the other store may be used without having to shut down the wireless communication system at the store, which is open 24 hours a day.

Therefore, for example, when the slave device **200** is moved from an original store to another store because another slave device **200** used in the other store is broken or the number of customers temporarily increase in the other store, the slave device **200** may be used easily in the other store. Also, when the slave device **200** is returned to the original store, there is no need to perform a particular registration operation of the slave device **200** with the master device **100**. Therefore, this is helpful for the store operation.

Next is an explanation of the way that the slave device **200** registers the master device **100** in the wireless communication system **1000**.

In the wireless communication system **1000**, information of the slave device **200** such as an IP address and MAC address is registered to the master device **100** in advance. The information of the slave device **200** is stored in, for example, the built-in memory **137** or the external memory **170**. In this case, the information of the slave device **200** is registered through a wired or wireless communication between the master device **100** and the slave device **200**. The information of the slave device **200** may be registered (paired) to the master device **100** from a remote place via a network.

Therefore, when the slave device is broken and has to be replaced by the new one, a dealer may register the slave device **200** to the master device **100** in a warehouse where the new slave device **200** is stored via the network. The dealer does not need to visit the store **10** to register the new slave device **200**. Also, the safety of the registration operation may be enhanced because a particular reliable worker may register the slave device **200** to the master device **100**.

Therefore, for example, information of the brand-new slave device **200** is registered in the master device **100** and the registration information of the master device **100** is stored in the memory of the brand-new slave device **200** by use of an actuator (not shown in the figures). The delivery agent may delivery the brand-new slave device **200** to the store **10**. In the store **10**, when a store clerk turns on the brand-new slave device **100**, the brand-new slave device **200** is activated as the slave device of the master device **100**. Therefore, the slave device **200** does not need to be registered in the store **10**. The brand-new slave device **200** is available immediately after the delivery of the brand-new slave device **200**.

The intercom system of JP-A-2012-124546, JP-A-2013-137755, and WO2011/102141 does not include a function to record a conversation among a plurality of wireless slave devices. Also, if the conversation among the plurality of wireless slave devices is always recorded by use of an analog terminal of the master device **100**, the amount of recoded data becomes rather large. Therefore, effective use of the memory is difficult and privacy is no well protected. Furthermore, if all conversation is always recorded, extracting the conversation of a specific time period among the plurality of wireless slave devices becomes difficult.

On the other hand, the master device **100** records audio and/or video when an event occurs (e.g. the button of the slave device **200** is pressed or the sensor detection). This may lead to protecting privacy and to ensuring security. Also, this may lead to reducing the amount of recoded data and to using the memory effectively compared to when the master device **100** always records audio and/or video. Also, the log information which the master device **100** retrieves at a specific time is linked to the audio data file. This may lead to managing the files easily and to checking the content of the recorded audio easily.

The slave device **200** may be easy to operate for communicating with the other slave devices and the order post **40**, and for instructing to record audio. This may lead to enhancing the user's convenience.

The wireless communication system **1000** records audio and/or video when an event occurs (e.g. the button of the slave device **200** is pressed or the sensor detection). This may lead to protecting privacy and to ensuring security. Also, this may lead to reducing the amount of recoded data and to using the memory effectively compared to when the master device **100** always records audio and/or video. Also, the log information which the master device **100** retrieves at a specific time is linked to the audio data file. This may lead to managing the files easily and to checking the content of the recorded audio easily.

This invention is not limited to the above construction of the embodiment.

For example, in the above embodiment, the wireless communication system **1000** is provided in one store **100**. However the wireless communication system **1000** may be provided in a plurality of stores **10**. Also, the wireless communication system **1000** may be connected to the public telephone network and at least a part of communication lines of the wireless communication system **1000** may be a public line.

As another example, an image mixing matrix unit may be used, which is comparable to the audio mixing matrix unit **120**, to process images taken by the monitoring camera(s) **50** according to a defined processing policy. This may lead to efficiently using the images taken by the monitoring camera(s) **50**.

In the above embodiment, generally, the main controller **110** records the audio data according to the configuration data. However, without recording audio, the main controller **110** may record only the image taken by the monitoring camera **50** or send an email. The main controller **110** performs at least one of the audio recording, video recording and email sending.

When the master device **100** records a video, the slave device **200** may have a video record button which, when actuates, triggers video recording, or the master device **100** may detect an instruction for video recording.

In the above embodiment, the audio record button **213** is pressed after the talk button **214** or the page button **215** of the slave device **200** is pressed. However the audio record

button **213** may be pressed before the page button **215** of the slave device **200** is pressed. Once the audio record button **213** is pressed, a speaker of other devices may output audio.

In the above embodiment, the mail sending controller **141** may generate mail text or a mail title according to the log information.

The present application is based on Japanese Patent Application No. 2013-152769 filed on Jul. 23, 2013, the contents of which are incorporated herein by reference.

What is claimed is:

1. A wireless communication apparatus which communicates with a first microphone and a wireless communicator having a second microphone, comprising:

an audio processor which acquires audio data from the first microphone;

a controller which detects an instruction for recording the audio data, the instruction for recording the audio data being generated by the wireless communicator;

an audio recorder which starts recording the audio data from the first microphone acquired by the audio processor according to the instruction for recording the audio data and stops the recording after a defined period of time since detection of the instruction for recording the audio data;

a timer which starts measuring time when the audio recorder starts the recording for the defined period of time; and

a memory controller which creates a recorded audio file including the audio data recorded by the audio recorder, the recorded audio file being linked to log information of communication between the wireless communication apparatus and the first microphone.

2. The wireless communication apparatus according to claim **1**, wherein

the memory controller assigns a name to the recorded audio file that includes time information of the instruction for recording the audio data.

3. The wireless communication apparatus according to claim **1**, wherein

the log information includes address information used to access the recorded audio file.

4. The wireless communication apparatus according to claim **1**, wherein

when the controller detects another instruction for recording the audio data within the defined period of time since detection of the instruction for recording the audio data, the audio recorder stops the recording after the defined period of time since detection of the another instruction for recording the audio data.

5. The wireless communication apparatus according to claim **1**, wherein

the controller detects the instruction for recording the audio data when the controller detects an occurrence of a defined event.

6. The wireless communication apparatus according to claim **5**, wherein the defined event is operation of an actuator.

7. The wireless communication apparatus according to claim **1**, further comprising a memory in which the recorded audio file is stored.

8. The wireless communication apparatus according to claim **1**, further comprising:

an image processor which acquires image data taken by an imager;

a second controller which detects an instruction for recording the image data;

an image recorder which starts recording the image data from the imager acquired by the image processor according to the instruction for recording the image data and stops recording the image data after a second defined period of time since detection of the instruction for recording the image data;

a second timer which starts measuring time when the image recorder starts recording the image data for the second defined period of time; and

a second memory controller which creates a recorded image file including the image data recorded by the image recorder, the recorded image file being linked to log information of communication between the wireless communication apparatus and the imager.

9. The wireless communication apparatus according to claim **8**, wherein the second defined period of time for image recording is the same as the defined period of time for audio recording.

10. The wireless communication apparatus according to claim **8**, wherein the instruction for recording the audio data serves additionally as the instruction for recording the image data, the controller that serves additionally as the second controller detects the instruction for recording the audio data as an instruction for both recording the audio data and the image data, the second defined period of time for imaging recording is the same as the defined period of time for audio recording, and the timer serves additionally as the second timer to measure the defined period of time and the second defined period time that are the same.

11. The wireless communication apparatus according to claim **1**, wherein the audio processor is an audio matrix unit.

12. A system comprising a wireless communication apparatus, a wireless communicator, and a first microphone, wherein

the wireless communicator includes:

a second microphone;

an actuator which, when activated, instructs a start of audio recording; and

a transmitter which transmits control data including information that the actuator is activated to instruct the start of the audio recording; and

the wireless communication apparatus includes:

an audio processor which acquires audio data from the first microphone;

a receiver which receives the control data from the wireless communicator;

a controller which detects an instruction for recording the audio data according to the control data;

an audio recorder which starts recording the audio data from the first microphone acquired by the audio processor according to the instruction for recording the audio data and stops recording the audio data after a defined period of time since detection of the instruction for recording the audio data;

a timer which starts measuring time when the audio recorder starts recording the audio data for the defined period of time; and

a memory controller which creates a recorded audio file including the audio data recorded by the audio recorder, the recorded audio file being linked to log information of communication between the wireless communication apparatus and the wireless communicator of the first microphone.

13. The system according to claim **12**, further comprising a second wireless communicator coupled to a third microphone; wherein

the audio recorder of the wireless communication apparatus selectively records one of first audio data from the first microphone and second audio data from the third microphone.

14. The system according to claim **12**, further comprising a second wireless communicator coupled to a third microphone; wherein

the audio recorder of the wireless communication apparatus uses different audio recording channels to record first audio data from the first microphone and second audio data from the third microphone, respectively.

15. The system according to claim **12**, wherein

the wireless communicator is a headset.

16. A data processing method of operating a wireless communication apparatus which communicates with a first microphone and a wireless communicator having a second microphone, the method comprising:

acquiring audio data from the first microphone;

detecting an instruction, from the wireless communicator, for recording the audio data;

starting recording the audio data from the first microphone according to the instruction for recording the audio data;

stopping recording the audio data after a defined period of time since detection of the instruction for recording the audio data; and

creating a recorded audio file including the recorded audio data, the recorded audio file being linked to log information of communication between the wireless communication apparatus and the first microphone.

17. The data processing method according to claim **16**, further comprising:

detecting another instruction for recording the audio data within the defined period of time since detection of the instruction for recording the audio data; and

stopping recording the audio data after the defined period of time since detection of the another instruction for recording the audio data.

18. The data processing method according to claim **16**, wherein

detecting the instruction for recording the audio data includes detecting operation of an actuator.

19. The data processing method according to claim **16**, further comprising:

acquiring image data from an imager;

detecting an instruction for recording the image data;

starting recording the image data from the imager according to the instruction for recording the image data;

stopping recording the image data after another defined period of time since detection of the instruction for recording the image data; and

creating a recorded image file including the recorded image data, the recorded image data file being linked to log information of communication between the wireless communication apparatus and the imager.

20. The data processing method according to claim **16**, further comprising:

acquiring second audio data from a third microphone;

detecting a second instruction for audio recording from the third microphone;

starting recording the second audio data from the third microphone according to the second instruction for audio recording;

stopping recording the second audio data after a second defined period of time since detection of the second instruction for audio recording; and

creating a second recorded audio file including the recorded second audio data, the second recorded audio file being linked to log information of communication between the wireless communication apparatus and the third microphone.

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